Plaintiffs' Exhibit 90

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Investigative Memorandum: App Developer Background

TO:	Gibson Dunn & Crutcher LLP
FROM:	Stroz Friedberg
DATE:	February 20, 2019
RE:	**AppBnk**
	Do Your Own Tarot Reading (115175461855084)
	Especially for You ≧☆‿☆≦ (118922418127206)
	Friend Hug (5655417519)
	Friends Special Gifts (113568525350263)
	Hola ♥ Especialmente para ti (103834412995260)
	How Crazy Are You? (122212057789970)
	Ilmu Al-Qur'an (127417643957553)
	love me tender , love me true,,(118844071480580)
	Love ♥ Peace ♥ Friendship ♥ (117879031581799)
	LoVe to YoU ❤~ (118271658193477)
	【 ‥♥ MEnSAjE De AMiSTaD ♥‥】 (215257591851492)
	morning and night greetings (117764461586633)
	Red Gifts (122917587728916)
	Roses Paradise (107138515996062)
	Send Flowers (8797258509)
	Send Kisses (7281078353)
	●‿● SMILE My FRIENDS ●‿● (111851152190480)
	Something Beautiful - Just For You (144158935594775)
	♥♥ Special for you ♥♥ (128416383852758)
	The Brain Dominance Test (119528164731932)
APP TYPE:	Quiz apps, virtual-gifting apps, social gaming apps

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Overall Summary and Reasons for Escalation

- This memorandum is Stroz Friedberg's ADI report on AppBank, a now-defunct application-publishing service that was the primary business interests of Delaware-incorporated Social App Holdings LLC. Within the Social App Developers category, AppBank was selected for investigation because it was identified as potentially high risk, according to the risk-prioritization methodology developed by FTI.

- AppBank's app development and publishing service provided various Facebook app templates to individual developers, who published apps through AppBank and then received a share of advertising revenue derived from these apps based on app traffic. This report includes the results of a background investigation on AppBank, Social App Holdings LLC, as well as 20 quiz, virtual-gifting, and gaming apps created or published by AppBank. These 20 apps were selected based upon the aforementioned risk-prioritization methodology.

Company Information

- **Founders and state registrations.** Founded in 2009 by three US-based individuals — Fred Hsu, Joyce Chang, and Kai Sung — AppBank is a Facebook application builder that generated revenue from advertisements placed in apps published through its services. AppBank appears to have been active between 2009 and 2013. AppBank's operating entity Social App Holdings LLC was incorporated in Delaware and had previously registered in Seattle and then San Francisco between 2009 and 2013. The company's registrations in these two states were cancelled in 2010 and 2013, respectively, and no information was identified to indicate the company is currently active.

- **Advertising, revenue, potential motives for misuse, and lack of evidence of misuse.** Media research uncovered that AppBank reportedly partnered with advertisers and ad networks to offer targeted advertisements in its published apps. The advertising revenue was in part shared amongst individual developers who published apps using its services. Moreover, one of the apps under review in this report was referenced in a user complaint about spamming activities on Facebook. And some developers of these apps were found to be linked to questionable activities that could be motives for misusing Facebook data, including online marketing and social media research. But no reference was uncovered to indicate that AppBank, any of the apps, or any app developers profiled in this report were involved in any misuse of Facebook data.

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- **Additional information:** The total number of authenticated users is 2,037,324 and there are 195 active users.

- **Additional Contact Information:** See Overall Summary

- **Targeted RFI Questions:** See Overall Summary

- **Permissions and API Calls Analysis:**

The app had access to a large number of permissions that likely fall outside the app's likely use case, such as friends permissions, and personal details (e.g., their religious beliefs, work/education history, relationship details), and data users uploaded to Facebook (e.g., their photos, videos, interests, events, statuses, and more). Each permission was granted by approximately 1,000 users, all during a period when the app had access to Graph API v1. Notably, the user_friends permission was granted by more than 2 million users. While this permission alone does not present a great risk, it may have allowed the app to infer the structure of Facebook's social graph. The permission may have had a use case within the app — as a means of facilitating a social feature within the app. But the enforcement histories for 4 of the apps listed in this report suggest that the app was instead using this information to spam users' friends with content — likely advertisements.

Notably, this app was created on May 1, 2010. Stroz Friedberg does not have access to logs pertaining to calls made before 2011, so it is likely that this app's API activity is not fully represented.

While the app had access to Graph API v1, the only call made by EFY that returned user data was a call to the User node (2.4 million calls). It is difficult to draw conclusions regarding the app's behavior because data-retrieval calls to the User node could potentially have had access to any edges associated with the User.

The only API calls made after Graph API v1 were OAuth calls. As such, after the switch to Graph API v2, no user data was collected.

Friend Hug

- **Developer Name:** Fred Hsu (AppBank)

- **Reason for Escalation:** AppBank is part of the Social Apps Category.

- **App Status:** Deleted by Facebook on an unknown date. Possible deletion date was indicated to be April 29, 2013

- **Preliminary Recommendation:** RFI

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- **Reason for Preliminary Recommendation:** This app was granted sensitive permissions by more than 12 million users, and is associated with a developer responsible for other questionable apps. The app previously used Graph API v1. There is little information available regarding the associated business entity and purpose of the app.

Background Summary

- **App Description:** "Friend Hug" ("FH") was likely a "Virtual Gifting App". It was published by AppBank on October 28, 2007.

- **Graph version:** v1

- **Special Relationship with Facebook:** None identified

- **Additional information:** The total number of authenticated users is 13,445,958 and there are 0 active users.

- **Additional Contact Information:** See Overall Summary

- **Targeted RFI Questions:** See Overall Summary

- **Permissions and API Calls Analysis:**

The app had access to a large number of permissions that likely fall outside the use case of the app, such as friends permissions, and personal data such as religious beliefs, work/education history, relationship details, and user generated content such as photos, videos, interests, events, statuses, and more. Each permission was granted by approximately 13 million users, all during a period when the app had access to Graph version 1.

As the app was created on October 10, 2007 and logs pertaining to calls made before 2011 are not available, it is likely that this app's API activity is not fully represented.

While the app had access to Graph API v1, the only call made by the app that returned user data were calls to the User node (19 million calls). It is difficult to draw conclusions regarding the app's behavior because data-retrieval calls to the User node could potentially have had access to any edges associated with the User.

Although API calls were made after Graph API v1, no user data was collected in the process.

Friends Special Gifts

- **Developer Name:** Mollie Nordin (AppBank)

- **Reason for Escalation:** AppBank is part of the Social Apps Category.

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approximately 800 users granted the app access to the above data types belonging to their friends, which further increases the volume of user data made available to the app.

The most commonly granted read permission was *user_friends* (approximately 1.2 million users), which is non-sensitive. While this permission alone does not present a great risk, it may allow the app to infer the structure of Facebook's social graph. The permission may have had a use case within the app as a means of facilitating a social feature within the app. But the enforcement histories for 4 of the apps listed in this report suggest that the app was instead using this information to spam users' friends with content — likely advertisements. Two other write permissions that allowed the app to publish to users' streams were granted by approximately 1.1 million users.

Since the overall the app's functionality could not be determined, it is unclear whether or not the app had a valid use case for any of these permissions, but it highly unlikely that it had a use case for all of them.

No API call data was recorded for the app under Graph API v1 or later — most likely because the app was granted its last permission in late 2011, before API call logging was implemented. As such, the app's data-collection practices cannot be reviewed.

Send Flowers

- **Developer Name:** Eddy Swain (AppBank)

- **Reason for Escalation:** AppBank is part of the Social Apps Category.

- **App Status:** Deleted by Facebook on an unknown date

- **Preliminary Recommendation:** RFI

- **Reason for Preliminary Recommendation:** The app could be considered a high-risk app based on the permissions requested, the associated risk score of those permissions, and the high number of users authenticated. Most of the permissions granted to over 3 million users were high-risk Graph API v1. These high-risk permissions do not appear necessary for the app's functionality.

Background Summary

- **App Description:** "Send Flowers" ("SF") was a virtual-gifting application created on February 20, 2008. The application allowed users to send virtual flowers to their friends and family.

- **Graph version:** Graph API v1

- **Special Relationship with Facebook:** None identified.

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- **Additional information:**
    - This app had 3,048,275 authenticated users and no active users.
    - The app was subject to Facebook enforcement actions in February 2013 over violations related to photo caption pre-fill activities.

- **Additional Contact Information:** See Overall Summary

- **Targeted RFI Questions:** See Overall Summary

- **Permissions and API Calls Analysis:**

A significant population of users (approximately 2 million) gave the ability to view their education history, notes, tagged photos and videos, relationship details, status, photo and video posts, work history, managed groups, "About Me", activities, interests, likes, events, and religious politics, as well as the same data from their friends. There is no apparent use case for these permissions.

This application also requested and was granted permissions relating to classes of data considered less sensitive, yet still significant.

A significant number of users (approximately 2 million) gave this application the ability to view the user's location, online presence, relationships, website, birth date, and hometown, as well as the same data from their friends. Over 3 million users granted the app permissions to access their friends list, and over 300,000 users granted the app permission to view their email. Where a user's email address and friends list may have a plausible use case for an application that is centered on sending virtual flowers, there is no apparent purpose for this application to view a user's hometown or website. While the *user_friends* permission alone does not present a great risk, it may allow the app to infer the structure of Facebook's social graph. The permission may have had a use case within the app as a means of facilitating a social feature within the app. But the enforcement histories for 4 of the apps listed in this report suggest that the app was instead using this information to spam users' friends with content — likely advertisements.

The first logged API activity using Graph API v1 occurred on November 29, 2011 and continued through February 22, 2015. While this activity appears to start significantly after the app's creation date of February 20, 2008, logs from before 2011 are inaccessible to Stroz Friedberg and are not included in this analysis. During this time period, more than 1 million queries were made to the node fql.query, which were queries made using Facebook's query language — and it is impossible to ascertain what information was being queried. The scope of the information retrieved through these queries was limited to the information made available to the app through the granted permissions. More than 6 million queries were made to the User node (which may have allowed access to user-

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granted information, such as birth date, location, hometown, etc.), as well as over 1 million calls to the user's friends lists. There were also approximately 600,000 write calls for sending user notifications. The queries for the user's friend list could be considered necessary for the basic functionality of this app. The other read requests appear questionable.

Send Kisses

- **Developer Name:** Eddy Swain (AppBank)

- **Reason for Escalation:** AppBank is part of the Social Apps Category.

- **App Status:** Deleted by Facebook on an unknown date

- **Preliminary Recommendation:** RFI

- **Reason for Preliminary Recommendation:** The app requested sensitive permissions that do not appear necessary and had a large number of authenticated users.

Background Summary

- **App Description:** "Send Kisses" ("SK") appears to be a virtual-gifting app for users to send virtual kisses to their friends. It was created on January 10, 2008.

- **Graph version:** Graph API v1

- **Special Relationship with Facebook:** None identified.

- **Additional information:**

  o   This app had 3,226,058 authenticated users and no active users.

  o   The app was subject to Facebook enforcement actions in February 2013 over violations related to photo caption pre-fill activities.

- **Additional Contact Information:** See Overall Summary

- **Targeted RFI Questions:** See Overall Summary

- **Permissions and API Calls Analysis:**

A significant population of users (approximately 2 million) gave this application the ability to view their education history, notes, tagged photos and videos, relationship details, status, photo and video posts, work history, managed groups, "About Me", activities, interests, likes, events, and religious politics, as well as the same data from their friends. There is no apparent purpose for this application to read the content of a

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user's posts or uploaded photos, the content of a user's friend's posts or uploaded photos, or have access to any other user data it has been granted.

A significant number of users (approximately 2 million) gave this application the ability to view the user's location, online presence, relationships, website, birth date, and hometown, as well as the same data from their friends. Over 3 million users granted the app permissions to access their friends list, and over 700,000 users granted the app permission to view their email. Whereas a user's email address and friends list may have a plausible use case, there is no apparent purpose to view a user's hometown or website. While the *user_friends* permission alone does not present a great risk, it may allow the app to infer the structure of Facebook's social graph. The permission may have had a use case within the app as a means of facilitating a social feature within the app. But the enforcement histories for 4 of the apps listed in this report suggest that the app was instead using this information to spam users' friends with content — likely advertisements.

The first logged API activity using Graph API v1 occurred on November 29, 2011 and continued through February 5, 2015. While this activity appears to start significantly after the app's creation date of January 10, 2008, logs from before 2011 are not accessible to Stroz Friedberg and are not included in this analysis. More than 600,000 queries were made to the node fql.query during this time period, which were queries made to Facebook's query language — and it is impossible to ascertain what information was being queried. The scope of the information retrieved through these queries was limited to the information made available to the app through the granted permissions. More than 4 million queries were made to the general User node edge (e.g., user-granted information, such as birth date, location, hometown), as well as over 700,000 calls to the user's friends lists. There were also approximately 475,000 post queries for sending out user notifications. The queries for the user's friend list could be considered necessary for the basic functionality of this app. The other read requests are questionable.

☻‿☻ SMILE My FRIENDS ☻‿☻

- **Developer Name:** Claudine Pikon (Appbank)

- **Reason for Escalation:** AppBank is part of the Social Apps Category.

- **App Status:** Disabled on June 23, 2011 by Facebook

- **Preliminary Recommendation:** RFI